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Caanen, J.C.; Kertzman, E.N.

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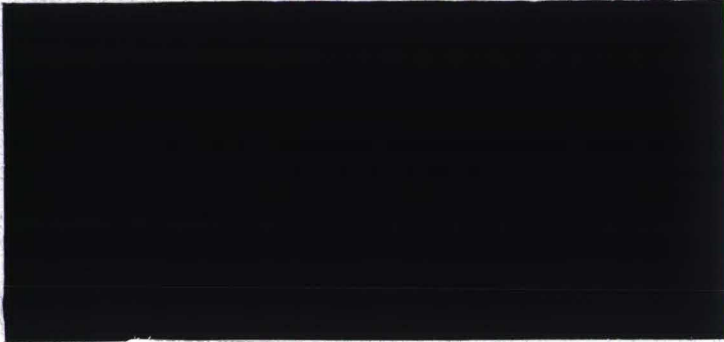
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**A COMPARISON OF TWO METHODS OF
INFLATION ADJUSTMENT**

J.Ch. Caanen and E.N. Kertzman

FEW 651



Communicated by Prof.dr. J.A.G. van der Geld

A comparison of two methods of inflation adjustment

1. Introduction

In 1997, EC member states will have to fulfil a number of conditions in order to be allowed entrance into the Economic and Monetary Union (EMU). It is not an absolute touchstone, but a relative one: inflation may not be 1.5%-points higher than the average of the three member states with the lowest inflation. In 1992 these three states had an average rate of inflation of about 3 percent. On average the member states had an inflation rate of 4.5 percent¹⁾ which means that in some member states inflation was much higher than the allowed 4.5 percent.

The persistence of inflation shows that paying attention to the relation between inflation and taxation is still of practical importance. In this paper, we report the results of a study conducted on the relation between inflation and the taxation of companies. Three factors determine what influence inflation has on the effective tax burden on companies: a) the way the tax base is calculated, b) the time lag between the time profits were generated and the moment the tax on these profits was paid and c) whether the tax scales are indexed or not in the case of progressive tax rates. This article addresses the question of how the tax base has to be calculated in order to ensure that only real profits are taxed leaving out illusory profits (and losses).

In the literature the so-called constant purchasing power (CPP) approach is often defended as a method by which inflation-neutral taxation of companies can be reached. In this paper we will not discuss this conclusion. Instead we will concentrate on whether the Dutch net equity deduction gives a good approximation of the results of CPP. Knowing this is important because this inflation adjustment method is a very simple one. The starting point in calculating the tax base is the profit and loss account and the balance sheet on historic cost basis. However, in times of inflation, companies are allowed to deduct from their historic cost profit a sum that is equal to equity on historic cost basis multiplied by the rate of inflation in consumption prices.²⁾ The combination of historic cost profit (HCP) and the deduction, will hereafter be abbreviated as NED.

¹⁾ OECD, Economic Outlook, Dec. 1993.

²⁾ In reality the deduction rate and the inflation rate were never exactly linked. However, in our analysis of NED, we will suppose that the first rate is exactly equal to the second rate.

This paper is organized in the following way: first we present a scheme for classifying and describing different techniques and systems that are or can be employed to adjust taxable profits for the inflation rate (section 2). Next we present a model to analyze the factors that determine the differences in outcome between CPP and NED (section 3). On the basis of this model, we estimate the extent to which CPP is approximated by NED. This is done for three different inflation patterns. One of these is the actual (average) rate of inflation in consumption prices of EC member states during the period 1981-1990 (section 4). Conclusions are presented in section 5.

2. A scheme for classifying the inflation adjustment techniques

In this section we will present an overview of the different ways for adjusting taxable profits for inflation. This is done for two reasons: 1. to show the place of CPP and NED in the whole of possible measures; 2. to classify the methods of inflation adjustment that are used in practice.

We discern comprehensive and partial methods of inflation adjustment and inflation adjustment by intention and as a byproduct of other measures.

2.1 Inflation adjustments of total profit

Total profits of companies consist of the sum of annual profits and capital gains plus the profit made on liquidation. The last profit can arise when a company is sold or liquidated. Capital gains are only considered to be taxable when realised. We will consider total taxable profits as adjusted effectively for inflation if price increases do not influence this profit expressed in constant prices. Because we focus on the total profit that flows ultimately to equity holders, the relevant price index to use here is that of consumption.³⁾ Furthermore, it is important to note that in calculating total profits at constant prices, the various amounts are aggregated without taking into account the time factor. Thus, no present value calculations based on the market interest are made. In this way the interest advantage resulting from taxing only realized capital gains is neglected. We will return to this in our analysis of CPP and NED.

There are two methods to prevent inflation from having an impact on the real value of total taxable profit:

- a. by an annual adjustment of the balance sheet and the profit and loss account along the CPP line in which the developments within the current year are also taken into

³⁾ For this reason a system like current cost accounting is left out of consideration. This system takes companies as going concerns as a starting point and therefore adjusts taxable profits on the basis of the specific price indexes of assets for the inflation rate.

account. This means, for instance, that an inflation adjustment is also made for a debt increase during the year. We will not analyze this rigid variant of CPP. In our analysis only the annual opening balance sheets are adjusted, leaving out the developments during the year. When the inflation level is not too high, this simplification does not cause a very big divergence from the correct result.

- b. By applying the NED deduction on taxable profits on historic cost basis every year. However, this method has to be seen as an approximation of a full inflation adjustment.

2.2 Partial adjustments

These adjustments only concern a part of annual taxable profits. They can be divided into two types. First, there are inflation adjustments of a part of the annual historic cost profit. These adjustments defer a part of the mere nominal profits to a later moment in time without influencing the sum of historic cost profits itself. As a consequence, total profit at constant prices declines. This happens, for instance under the LIFO system. Secondly, there are downward adjustments of a part of total historic cost profits; for instance, by adjusting capital gains for inflation.

2.3 Inflation adjustments by intention and as a byproduct

Inflation adjustment systems can be intentional and (only) by effect. Inflation adjustment systems by effect are introduced for other reasons, the inflation adjustment is only a byproduct. For instance, accelerated depreciation is often introduced as an investment incentive, but can also be considered as an inflation adjustment concerning fixed assets.

3 Inflation adjustment systems in the European Community

In this section, we will present a short inventory of inflation adjustment systems existing in the European Community. In most EC countries, inflation adjustment methods are partial and concern the treatment of capital gains and stocks.

3.1 Treatment of capital gains

According to the Ruding Committee Report⁴⁾, three types of adjustment exist in Europe: an inflation adjustment of nominal capital gains, taxation of nominal capital gains at a

⁴⁾ European Communities-Commission Report, Report of the Commission of Independent Experts on Company Taxation, Luxembourg, 1992. ("The Ruding Commission Report")

special rate and a tax deferral if capital gains are reinvested. These adjustments apply to realized capital gains; non-realized gains are not taxed at all.

Inflation adjustment is practised in Ireland, Portugal and the United Kingdom. A special rate often depends on the holding period of the asset. For instance, in Ireland after a holding period of less than three years, the tax rate is 50%, from three to six years it is 35% and from six and more years, 30%. Special rates also exist in Belgium, Greece and France. Tax deferral is allowed in all European countries with the exception of Denmark, Greece, France and Italy.

3.2 Treatment of stocks

The Ruding Committee Report recommends the introduction of a free but irrevocable choice between FIFO, LIFO, average cost or base stock for business enterprises. At the moment most countries allow LIFO; only Spain, France, Ireland and the United Kingdom do not. Base stock is only allowed in the Netherlands.

3.3 Other measures

In Denmark in the period 1982-1990 indexation of the depreciation base of fixed assets was applied.⁵⁾ During periods of high inflation, Italian, Spanish and Portuguese tax law apply incidental fiscal revaluation of business assets. Revaluation means that companies have to express their assets at current instead of historic prices at their balance sheets; this is done, however without having to pay any taxes or only partial taxes on the capital gains that become manifest in this way.

In Italy, the latest revaluation was brought about by Law 408 of 29 December 1990 (1991 Finance Act). It concerned buildings and areas zoned for construction. The amount of the revaluation was subject to a special 16% tax. The new values will be the basis for future depreciation. In Spain, similar legal revaluations were applied in 1964, 1979, 1980, 1981 and 1983.⁶⁾ The unrealized capital gains were exempted from tax. Portugal too applies the ad-hoc revaluation of certain assets (plant and machinery). The most recent revaluation took place in 1991.⁷⁾ Capital gains were exempted from tax but only increased for 60% the fiscal depreciation base.

In the Netherlands, a net equity deduction is applied. It was introduced in 1981.⁸⁾

⁵⁾ The measure was introduced by Law No. 197 of 18 May 1982 and abolished by Law No. 217 of 10 April 1991.

⁶⁾ Decree 1985/1964, Law 1/1979, Law 42/1979, Law 74/1980 and Law 9/1983.

⁷⁾ Decree-Law 49/91 of 25 January 1991.

⁸⁾ Law of 24 June 1981.

Every year a certain percentage of the net equity on historic cost basis is deducted. It is a rough system, because the deduction rate and the inflation rate were never exactly linked. In 1993 the deduction rate for companies to which the personal income tax applies was 1%. For companies that are taxed under the corporate income tax, it is 0%.

4. EC practice and NED

The non-uniform, partial ad hoc base in which the EC countries adjust taxable profits for inflation makes the question to what extent NED approximates CPP a very relevant one. If NED does this rather well, the question arises whether NED would not be a good system of inflation adjustment to replace the variety of systems that nowadays exist within the EC.

3. A model to compare current purchasing power profit and net equity deduction

3.1 Starting points

In the previous sections we described how inflation adjustment techniques can be distinguished and what techniques are actually used in practice. In this section we will compare two comprehensive systems, namely, current purchasing power profit (CPP) and the net equity deduction (NED).

3.2 The theoretical concept

In order to analyse under what conditions NED approximates CPP, we will use the following simple accounts:

Table 1.
Balance sheets on historic prices per 1-1.

Land	L^h	Equity	E^h
Buildings	B^h	Debt	D^h
Replacement funds buildings	B^{rh}		
Equipment	Q^h		
Inventories	S^h		
Monetary assets	M^h		

Table 2.

Balance sheets on constant purchasing power basis per 1-1.

Land	L^c	Equity	E^c
Buildings	B^c	Debt	D^c
Equipment	Q^c		
Inventories	S^c		
Monetary assets	M^c		

The two accounts apply to the same company and are based on the following suppositions:

1. In Table 1 all items are expressed at historic cost prices. This is denoted by the superfix h. Table 2 is on constant purchasing power basis; therefore the superfix c is used.
2. The value of land and equipment in Table 2 is equal to the value in Table 1 multiplied by the appropriate **consumption** price indexes. All assets besides buildings that are depreciable are considered as equipment. According to this definition, not only machines but also assets such as cars and office machines are part of the equipment. For the sake of simplicity, we suppose, however, that equipment consists only of machines.
3. Land represents assets that do not deteriorate physically.
4. As will be explained more in detail in section 4 we presume that concerning equipment a vintage model is actual. However, to apply this supposition to buildings would not be realistic. Nevertheless, we will depart in our analysis from some regularity of investments in buildings. In particular: starting from a useful economic life of 40 years, we assume that there are always two identical buildings present that were bought at intervals of 20 years. A company that started in year 0 therefore has in year 40 a brand new and a 20 year-old-building. For each building there is a separate replacement fund in which the depreciation charges on that building flow.⁹⁾ After 40 years the sum of these charges is supposed to be large enough to finance a new building. The sum of the CPP values and the two replacement funds is denoted by B^c . The starting point in section 4 is that B^c increases each year at the same rate as consumption prices. This implies not only that each year the CPP depreciation charges flow into the replacements funds, but also that the already accumulated funds increase

⁹⁾ Of course we could also have assumed that there is only one replacement fund in which each year the depreciation charges on both buildings flow in order to finance each 20th year a new building. This alternative does lead to the same results when we simulate the differences between CPP and NED and will be further neglected.

annually at the rate of inflation in consumption prices. (From now on the expression rate of inflation refers to the rate of inflation in consumption prices.)

The buildings and the replacement funds are shown separately on the historic cost balance sheet. Both will increase each year at a rate that is different from the rate of inflation. The same applies to the sum of buildings and replacement funds.

5. Inventories have a turnover period of one year. They are fully used in the production process on 31/12. Next 1-1 the inventories are brought back to the old level by way of purchases. As a result, per 1-1 the value of inventories at historic and constant purchasing power basis are equal; therefore S^h equals S^c .
6. Monetary assets and debt are by definition equal on both bases because the price of one guilder is always one guilder.

In the analysis of the difference between CPP and NED it was supposed that our company would exist during a certain period and will then be sold. Concerning capital gains it was assumed that these gains are only taxable when realized; this is when the whole company or separate assets are sold. However, the last possibility has been made abstract in this paper.

On the basis of these suppositions total taxable profit, the sum of the annual taxable profits and the taxable capital gains, is equal according to CPP and NED if two conditions are met: a) one has to express these profits and gains in constant consumption prices and b) the time factor is neglected by simply adding up profits and gains without discounting them. In other words: the equality implies that in real terms the sum of the differences in annual taxable profits is offset by the difference in taxable capital gains. This can be also pressed in a formula: if after the sale of the company in period z E_z^v is left to the stockholders, CPP and NED will tax $(E_z^v - E_z^c)$ and $(E_z^v - E_z^h)$ respectively as capital gains.¹⁰⁾ In this case taxable capital gains in CPP are $(E_z^c - E_z^h)$ lower as compared to NED. It will be proved that in real terms this difference equals the (positive) sum of the differences in annual taxable profits between CPP and NED. However, as mentioned before, in this comparison the time factor is neglected. After analyzing the annual differences in annual taxable profits, therefore, these differences were quantified using a simulation for the years that the company exists. This makes clear how these differences are distributed in time.

¹⁰⁾ When a company is sold historic cost profit (and also NED) tax the amount left to the equity owners (E_z^v) minus the value of equity on historic cost basis (E_z^h) as capital gains. CPP taxes E_z^v minus the value of equity on CPP basis (E_z^c). In this way historic cost profit taxes all capital gains. CPP taxes those capital gains that are real on the basis of the consumption price index.

3.3.1 Constant purchasing-power profit.

The adjustments to annual historic cost profit which were necessary in order to arrive at constant purchasing power profit were investigated. Corrections that, in comparison with historic cost profit, lower the tax base have a - sign; increases have a + sign. The correction excludes capital gains because these are assumed not to be taxed on an accrual basis.

The total correction (C_t) that has to be made in period t equals:

$$C_t = -f_t \cdot B_t^{rh} - f_t \cdot S_t^c - f_t \cdot M_t^c + f_t \cdot D_t^c - (A_t^{bc} - A_t^{bh}) - (A_t^{qc} - A_t^{qh}) \quad (1)$$

Explanation.

- * $f_t \cdot B_t^{rh}$ stands for the decline in purchasing power of the replacement funds for buildings. These funds are not explicitly mentioned in the CPP balance because there they are a part of B_t^c . However, because of the monetary nature of these funds, their CPP value equals the value on the historic cost basis.
- * At historic cost the use of inventories in the production process equals S_t^c . On the CPP basis this has to be $S_t^c \cdot (1 + f_t)$. The increase in consumption prices in period t has the symbol f_t .
- * $f_t \cdot M_t^c$ symbolizes the decline in purchasing power on behalf of monetary assets; $f_t \cdot D_t^c$ represents the decrease in the real value of debt because of inflation.
- * $(A_t^{bc} - A_t^{bh})$ represents the difference between depreciation on the CPP and HCP basis for buildings. To calculate A_t^{bc} historic cost prices are inflated with the consumption price index. In a similar manner $(A_t^{qc} - A_t^{qh})$ is calculated: the difference between depreciation on CPP and HCP basis for equipment.

For (1) can also be written:

$$C_t = -f_t \cdot E_t^c + f_t \cdot B_t^c + f_t \cdot L_t^c + f_t \cdot Q_t^c - f_t \cdot B_t^{rh} - (A_t^{bc} - A_t^{bh}) - (A_t^{qc} - A_t^{qh}) \quad (2)$$

On the basis of (2) the correction can be explained as follows: in economic terms annual profit equals the increase in the value of equity before the distribution of dividends. To calculate this increase on a real basis, the nominal increase of equity, $f_t \cdot E_t^c$, has to be deducted from this increase. For the category land, however, this deduction is too large because in our model capital gains are not taxed on an accrual basis. This correction is also unnecessary for buildings and equipment; however depreciations and the replacement

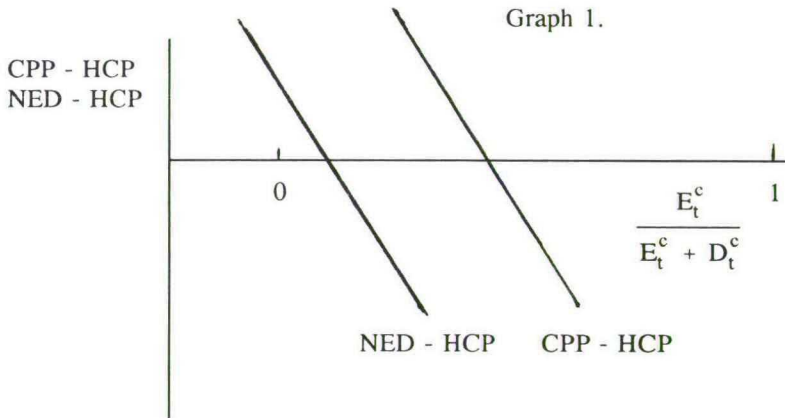
fund do, however have to be corrected for the rate of inflation.¹¹⁾

3.3.2 NED.

NED can also be explained as an adjustment of historic cost profit. The difference between NED and HCP equals $(-f_t \cdot E_t^h)$.

2.3.3 A graphical representation.

In graph 1 the differences between the tax bases are illustrated. $CPP - HCP$ represents the difference between constant purchasing power and historic cost profit; $NED - HCP$ the difference between NED and historic cost profit.



Because $CPP - HCP$ is equal to C_t (see eq. 1 and 2) this difference can be easily explained on the basis of (2) starting from the position that : $f_t \cdot E_t^c = f_t \cdot L_t^c + f_t \cdot B_t^c + f_t \cdot Q_t^c$. In that case the difference between CPP and HCP becomes $-(A_t^{bc} - A_t^{bh}) - (A_t^{qc} - A_t^{qh}) - f_t \cdot B_t^{rh}$. The higher the rate of inflation in year t and the past, the higher this difference will be. Moving to the right it can be seen what happens when equity finance is substituted for debt finance.¹²⁾ According to CPP there are less inflationary gains on debt

¹¹⁾ Implicitly it is assumed in this explanation that land, buildings and equipment are equity financed. If L_t^c , B_t^c and Q_t^c are debt financed $f_t \cdot L_t^c$, $f_t \cdot B_t^c$ and $f_t \cdot Q_t^c$ represent the inflationary gains on that debt which are taxable when CPP applies.

¹²⁾ In the graph, the financial structure $E_t^c / (E_t^c + D_t^c)$ is the only variable. Negative values for this variable are not realistic for a long period but are, nevertheless, taken into consideration in order to analyze the position of companies which have a negative equity value. Companies with a small positive value for $(E_t^c / (E_t^c + D_t^c))$ may have a negative E_t^h because in times of inflation $E_t^c > E_t^h$ will hold. Thus for a negative value and a small positive value of E_t^c NED will imply that an addition instead of a deduction to HCP is actual.

The rate at which this happens will be greater, the higher the rate of inflation. Therefore the line CPP - HCP will be steeper as a function of the rate of inflation.¹³⁾

The difference between taxable profits on the basis of NED and HCP equals $(-f_t \cdot E_t^h)$. Here again, moving to the right increases the difference when equity is substituted for debt finance. Likewise this line is steeper the higher the rate of inflation in year t .¹⁴⁾ Whether the line NED-HCP lies under (as depicted in the graph) or above the line CPP-HCP depends on the concrete circumstances. To explain the following equality based on table 1 and 2 will be used as a departure point:

$$-f_t \cdot E_t^c + f_t \cdot L_t^c + f_t \cdot B_t^c + f_t \cdot Q_t^c = -f_t \cdot E_t^h + f_t \cdot L_t^h + f_t \cdot B_t^h + f_t \cdot B_t^{rh} + f_t \cdot Q_t^h \quad (3)$$

In order to analyse the relation between CPP and NED (2) can be rewritten using (3) as:

$$C_t = -(f_t \cdot E_t^h - f_t \cdot L_t^h - f_t \cdot B_t^h - f_t \cdot Q_t^h) - (A_t^{bc} - A_t^{bh}) - (A_t^{qc} - A_t^{qh}) \quad (4)$$

On the basis of (4) and the NED correction $(-f_t \cdot E_t^h)$ deductions can be made for the difference between taxable profits according to CPP and NED:

$$CPP_t - NED_t = f_t \cdot (L_t^h + B_t^h + Q_t^h) - (A_t^{bc} - A_t^{bh}) - (A_t^{qc} - A_t^{qh}) \quad (5)$$

The difference between CPP and NED depends, as can be seen in (5), on the level of past investments in land, buildings and equipment (L_t^h , B_t^h , and Q_t^h), the rate of inflation in year t and the rate of inflation in the past ($A_t^{bc} - A_t^{bh}$) and ($A_t^{qc} - A_t^{qh}$). As a result, the difference can be positive as well as negative. The financial structure of the company does not have an influence on the difference; however, in relation to equity the importance of the difference increases as the relative importance of equity finance declines.

2.4 Total profits

Until now, the emphasis has been on the differences between CPP and NED annual profits, without taking total profits, the sum of annual profits and capital gains, into consideration. In order to determine total profits, it is assumed that at a given moment in time (z) the company is sold. At that moment, according to earlier suppositions, capital gains are taxable. As was previously mentioned capital gains according to CPP are $(E_z^c -$

¹³⁾ From (2) can be deducted that $dC_t/d\{E_t^c/(E_t^c + D_t^c)\} = -f_t \cdot (E_t^c + D_t^c)$.

¹⁴⁾ For NED holds that $d(NED_t - HCP_t)/d\{E_t^c/(E_t^c + D_t^c)\} = -f_t \cdot (E_t^c + D_t^c)$. This relation is the same as the relation for C_t . This implies that the absolute difference between NED and CPP is independent of the financial structure. This is also demonstrated by (6).

E_z^h) lower than these gains on the basis of NED.

It can be proved that the summation of the differences between the annual taxable profits according to CPP and NED from the start of a company (period 0) to a period t equals $(E_t^c - E_t^h)$ when all differences are expressed in constant consumption prices (the prices at 1-1 of period t). Therefore this relation will also hold for the period z in which the company is sold. As a consequence, total profits in real terms are the same for CPP and NED.

The difference $(E_t^c - E_t^h)$ at the beginning of a period t equals¹⁵⁾:

$$E_t^c - E_t^h = (E_{t-1}^c - E_{t-1}^h)(1 + f_{t-1}) + [f_{t-1} \cdot L_{t-1}^h + f_{t-1} \cdot Q_{t-1}^h + f \cdot B_{t-1}^h - (A_{t-1}^{qc} - A_{t-1}^{qh}) - (A_{t-1}^{bc} - A_{t-1}^{bh})] \quad (6)$$

From (5) follows that:

$$CPP_{t-1} - NED_{t-1} = [f_t \cdot L_{t-1}^h + f_t \cdot Q_{t-1}^h + f \cdot B_{t-1}^h - (A_{t-1}^{qc} - A_{t-1}^{qh}) - (A_{t-1}^{bc} - A_{t-1}^{bh})] \quad (7)$$

¹⁵⁾ From table 1 and 2 follows:

$$E_t^c - E_t^h = (L_t^c - L_t^h) + (B_t^c - B_t^h) + (Q_t^c - Q_t^h) - B_t^{rh} \quad (a)$$

For land:

$$L_t^c = L_{t-1}^c(1 + f_{t-1}) \quad (b)$$

$$L_t^h = L_{t-1}^h \quad (c)$$

For Q_t^c and Q_t^h can be written:

$$Q_t^c = Q_{t-1}^c(1 + f_{t-1}) - A_{t-1}^{qc} + I_t^q \quad (d)$$

$$Q_t^h = Q_{t-1}^h - A_{t-1}^{qh} + I_t^q \quad (e)$$

I_t^q represents the investments in equipment at current prices in period t .

By assumption:

$$B_t^c = B_{t-1}^c(1 + f_{t-1}) \quad (f)$$

The sum of buildings at historic cost and the replacement fund in years that no new buildings are purchased equals:

$$B_t^{ht} + B_t^{rh} = B_{t-1}^h - A_{t-1}^{bh} + B_{t-1}^{rh}(1 + f_{t-1}) + A_{t-1}^{bc} \quad (g)$$

In years of investment in buildings the new investment minus the replacement fund has to be added in (g). However this sum equals zero and is, therefore, omitted in (g). Thus in these years (g) correctly represents the sum of $B_t^{ht} + B_t^{rh}$.

By substituting b,c,d,e, f and g in a, (6) can be deducted.

Together, (6) and (7) imply that a too-low annual taxable profit when NED is applied ($CPP_{t-1} > NED_{t-1}$) is reflected in a pro-tanto increase in the difference between E_t^c and E_t^h . If the difference between E_t^c and E_t^h as a company starts is denoted as F_0 and the yearly differences between CPP and NED as K_t , then for every period t the following relation holds true:

$$E_t^c - E_t^h = F_0 \prod_{j=0}^{t-1} (1 + f_j) + K_0 \prod_{j=1}^{t-1} (1 + f_j) + K_1 \prod_{j=2}^{t-1} (1 + f_j) \dots + K_{t-1} \quad (8)$$

When a company starts, F_0 is zero because then E_0^c equals E_0^h . As a result differences in annual taxable profit will be reflected in a difference in taxable capital gains that in real terms is the same.

4 The simulation.

4.1 Starting points for the simulation.

Our simulation of the difference between CPP and NED is based on the supposition that for individual companies all assets and liabilities on the CPP balance increase each year at the rate of inflation in consumption prices. As a consequence the structure of assets of individual companies is constant in time; the same applies to the financial structure of the companies.

The result of these suppositions is that the past and actual rates of inflation are the only variables in the simulation model for individual firms. Of course, the model can also analyse the impact of inflation on companies that have a different structure of assets and liabilities.

In order to show what the suppositions imply (5) is rewritten as:

$$CPP - NED = f_t \cdot L_t^h + [f_t \cdot B_t^h - (A_t^{bc} - A_t^{bh})] + [f_t \cdot Q_t^h - (A_t^{qc} - A_t^{qh})] \quad (5')$$

It can be proved that when Q_t^c increases each year at the rate of inflation in consumption prices, the same applies to Q_t^h . Moreover, this supposition implies that at constant consumption prices machines are installed in a sequence of vintages for which the rate of installation is constant in time. Furthermore, this situation must already exist for a period of time that is equal to the service life of equipment. In that case each year the oldest vintage is replaced by a new one that, abstracting from depreciation, has the same value at constant consumption prices.

The supposition that the value of equipment on the CPP balance increases each year at the rate f does not imply that a zero real rate of growth of investments is also assumed. An increase of investments at current prices at the rate f can imply two things:

at the rate f does not imply that a zero real rate of growth of investments is also assumed. An increase of investments at current prices at the rate f can imply two things:

- a. The volume of investments in equipment is constant in time and the inflation rates in consumption (f) and equipment prices (Π) are always equal.
- b. The rate of growth of the volume of investments in equipment (g) is positive and always equal to the difference between the rate f and Π . So $g = f - \Pi$ and, therefore, the rate of growth of these investments in current prices will be equal to f ($g + \Pi = f$). In reality $\Pi < f$ ¹⁶⁾ applies, so the supposition that investments in equipment in current prices increase at the rate f does not imply that the real growth of these investments is completely neglected.

From this point on, the supposition concerning equipment will be denoted as a combination of an equal increase of consumption and equipment prices without real growth of investments. In the case of a constant rate of inflation it can be proved mathematically¹⁷⁾ that this supposition barely influences the difference CPP - NED compared with realistic assumptions concerning Π , f and g . By way of a simulation can be demonstrated that the same applies for a variable rate of inflation.

If the rate of inflation were constant in time our assumptions would imply that the second term between square brackets in (5') is zero. This can be proved mathematically.¹⁸⁾ In our simulation, however, the value of this term is calculated on the basis of the actual rate of inflation.

It is also presumed that the CPP value for buildings increases each year at the rate of inflation. As was mentioned before, this value includes the so-called replacement funds. As was explained previously a perfect-vintage model for buildings is not realistic. Thus the first term between square brackets will not equal zero for a constant rate of inflation.

4.2 The more specific assumptions

As (5') shows, the differences between taxable profits on the basis of CPP and NED are ultimately caused by a different treatment of equipment, buildings, and land. The same applies to the differences in capital gains as can be deduced from table 1 and 2. The magnitude of these differences have been simulated for a ten year period for three patterns of inflation. One of these patterns is the average rate of inflation in consumption

¹⁶⁾ In the Netherlands during the period 1961-1985, the rate of inflation in consumption prices was 5,3 percent a year. During the same period, the price increase of machines was 4,5 percent. The rate of inflation for other kinds of equipment was lower, e.g., 3.3 percent for transport vehicles and -0,5 percent for office equipment (Source: Netherlands Central Bureau of Statistics).

¹⁷⁾ On the basis of a vintage model for equipment this is proved in the appendix.

¹⁸⁾ See the appendix.

less declined.¹⁹⁾ The other patterns are rates of inflation that are, constant and increasing in time respectively.

Above the general starting points for our simulation have already been outlined. The more specific assumptions will be explained below for the case of the actual EC-rate of inflation during the period 1981-1990. The specific assumptions are the following:

- Land was purchased in 1971. This is necessarily a rather arbitrary supposition because the land the company owns per 1-1-1981 could have been bought in segments at different points in the past.
- There are two buildings with a service life of 40 years. One building was purchased in 1951; the other one in 1971. This assumption is likewise arbitrary. However, the general tendency of the results of the simulation does not depend on the choice of these two specific years.
- The service life of equipment is ten years. Because it is supposed that a vintage model is actual this implies that from 1971 on, the volume of investments in equipment each year was the same.
- As the rate of inflation during the period 1971-1980 the average EC-rate during that period is used. This rate of inflation is needed to calculate the CPP values of buildings and land per 1-1-1980. As the oldest building was purchased in 1951 it is also necessary to know the rate of inflation during the period 1951-1971. For this period we have set the rate and pattern of inflation equal to those for the period 1971-1990.²⁰⁾

For the case of a constant and increasing rate of inflation the same time pattern of investments in land, buildings, and equipment are assumed. As a constant rate of inflation a rate of 6 percent is used. This rate equals the average rate of inflation during the period 1981-1990. This rate is also supposed to be actual during the 30 years that preclude our 10 year simulation period.

For the case of an increasing rate of inflation the average EC-rate of inflation is used. More specifically the average EC-rates of inflation for the period 1971-1990, the ten years of the simulation and the decade before, have been positioned in an increasing order. The same rates and pattern are supposed to apply for the 20 years before that correspond with the period 1951-1970.

¹⁹⁾ This period can also be described as one in which the inflation rate at first declined in time and then rose again at the end of the period.

²⁰⁾ This rate of inflation was about 2%-points higher than the rate for the major EC-countries (Italy, Germany, United Kingdom, France) during the period given (see Agnus Maddison, *Dynamic Forces in Capitalist Developments*, p.304-307). However, this barely influences the results of the simulation. For instance, the difference between capital gains on buildings on the basis of CPP and NED as a percentage of B_t^c are about 0.5 %-points overestimated.

4.3 The results.

Firstly, the annual differences between the CPP and NED taxable profits and capital gains will be presented. Taxable capital gains are defined as the gains that would be taxable if the company was sold at the end of the year. More specifically, the difference in capital gains represents the extra capital gains that are taxed under NED in comparison with CPP. The above-mentioned differences are independent of the financial structure of the company. To express this, these differences are related to the CPP value of total capital (equity plus debt) of the companies (table 3).

Differences in annual profits.

The differences in annual taxable profits (table 3, 4-7) and capital gains (table 3, 8-11) are first shown for equipment, buildings, and land, separately. The calculations are done as if each of them was the only asset on the balance sheet. Under "Total" the results are mentioned for a balance sheet with equipment, buildings, land, inventories, and monetary assets. They all represent 20 percent of total assets. When the shares of the respective assets in the total assets are changed, a different weighted average will result; in other words the overall differences depend on the composition of the assets on the balance sheets.

The results for annual profits can be summarized as follows:

- For a constant rate of inflation the differences in annual taxable profits between CPP and NED are zero for equipment. Because the differences for buildings and land are positive the same applies to the total differences.
- For a decreasing rate of inflation (the EC-pattern)²¹⁾ the differences for equipment are negative. This means that the CPP-adjustments are greater than the NED-adjustments. These negative differences compensate for the positive building and land results which, in turn, results in a small total negative or positive difference.
- For an increasing rate of inflation all separate differences are positive (the NED-adjustments are greater) which leads to relatively large total differences.

²¹⁾ In tables 3, 4, and 5 the figures of the years in which inflation decreased (1981-1986 and 1990) are printed in bold print.

Table 3.

The differences between CPP and NED in annual tax bases (4)-(7) and capital gains (8)-(11) (as a percentage of total capital CPP value).

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Constrant rate of inflation										
1	6.0	6.0	0.0	2.5	3.2	1.13	-15.2	-26.6	-47.3	-17.82
2	6.0	6.0	0.0	2.5	3.0	1.09	-15.2	-26.1	-50.3	-18.31
3	6.0	6.0	0.0	2.5	2.8	1.07	-15.2	-25.4	-53.1	-18.74
4	6.0	6.0	0.0	2.5	2.6	1.03	-15.2	-24.6	-55.8	-19.11
5	6.0	6.0	0.0	2.5	2.5	1.01	-15.2	-23.8	-58.3	-19.42
6	6.0	6.0	0.0	2.5	2.4	0.98	-15.2	-22.6	-60.7	-19.68
7	6.0	6.0	0.0	2.6	2.2	0.96	-15.2	-21.4	-62.7	-19.89
8	6.0	6.0	0.0	2.6	2.1	0.94	-15.2	-20.1	-65.0	-20.05
9	6.0	6.0	0.0	2.6	2.0	0.92	-15.2	-18.7	-67.0	-20.17
10	6.0	6.0	0.0	2.7	1.9	0.91	-15.2	-17.2	-68.8	-20.25
Decreasing rate of inflation (EC inflation 1971-1990)										
81	6.3	11.7	0.3	4.9	3.9	1.83	-25.2	-34.5	-66.4	-25.20
82	6.3	10.4	-0.5	4.2	3.2	1.38	-24.6	-33.7	-69.6	-25.58
83	9.0	8.1	-1.6	3.0	2.3	0.74	-23.1	-32.5	-71.8	-25.48
84	14.3	6.8	-1.9	2.3	1.8	0.43	-21.1	-31.0	-73.6	-25.16
85	13.3	5.5	-2.2	1.5	1.4	0.14	-19.0	-29.4	-75.0	-24.67
86	11.2	3.2	-3.1	0.0	0.8	-0.45	-15.8	-27.5	-75.8	-23.82
87	11.1	3.2	-2.4	0.1	0.7	-0.30	-13.5	-25.6	-76.5	-23.11
88	8.6	3.4	-1.7	0.3	0.8	-0.11	-11.8	-23.7	-77.3	-22.55
89	10.2	4.6	-0.3	1.2	1.0	0.38	-11.5	-21.8	-78.3	-22.30
90	12.9	4.2	-0.4	1.0	0.9	0.31	-11.2	-19.8	-79.2	-22.02
Increasing rate of inflation										
1	3.2	8.6	1.4	4.2	4.8	2.06	-18.0	-25.9	-44.2	-17.63
2	3.2	9.0	1.2	4.4	4.6	2.04	-19.1	-26.0	-48.8	-18.80
3	3.4	10.2	1.5	5.2	4.7	2.27	-20.6	-25.9	-53.6	-20.03
4	4.2	10.4	1.1	5.2	4.4	2.15	-21.7	-25.7	-58.0	-21.07
5	4.6	11.1	1.1	5.6	4.2	2.19	-22.9	-25.2	-62.2	-22.03
6	5.5	11.2	0.8	5.7	3.8	2.06	-23.7	-24.4	-66.0	-22.81
7	6.3	11.7	0.8	6.0	3.6	2.07	-24.5	-23.5	-69.5	-23.50
8	6.3	12.9	1.1	6.8	3.5	2.28	-25.6	-22.5	-73.0	-24.21
9	6.8	13.3	1.0	7.1	3.2	2.25	-26.6	-21.2	-76.2	-24.78
10	8.1	14.3	1.1	7.8	3.0	2.39	-27.6	-19.8	-79.2	-25.32

(1) Years of the simulation period, (2) and (3) the inflation during the 10 years before and within the simulation period, respectively (4) Equipment, (5) Buildings, (6) Land, (7) Total, (8) Equipment, (9) Buildings, (10) Land, (11) Total.

That the annual differences between the CPP and NED tax base are independent of the financial structure does not imply that the same is true of the differences CPP - HCP

and NED - HCP (both as a percentage of total capital). In fact, these differences are influenced by the financial structure (see section 3.3.3) but this influence is cancelled out when one compares CPP and NED.²²⁾

The results for capital gains.

The differences in capital gains are always negative for the three assets. This means that capital gains are higher under NED than under CPP.²³⁾ The differences are substantial. As was demonstrated above, the differences in capital gains and annual profits are cancelled out at constant consumption prices if one neglects time preferences. If one does not abstractify for time preference it has to be concluded that companies (equity holders) will prefer NED above CPP because in time the advantages concerning annual profits will outweigh the disadvantages concerning capital gains.

The impact of the financial structure and the tax rate.

As was stated before, the differences between CPP and NED as a percentage of total capital do not depend on the financial structure of the company. However, if we want to express the differences as a percentage of equity the financial structure becomes relevant. For instance, if equity is 20, 33.3, or 50 percent of equity plus debt the figures from table 3 have to be multiplied by 5, 3, and 2, respectively. As a consequence, the importance of the choice between CPP and NED increases when one considers inflation adjustment desirable for a fair treatment of equity holders.

The importance of an inflation adjustment to equity holders also depends on the tax rate. Therefore, calculations for the EC-pattern of inflation have been done to indicate which impact CPP and NED have on the annual **post-tax rate of return** on the CPP value of equity. To calculate this the Dutch tax rate on companies of 35 percent was used. This rate is also representative of other western countries. Three differences in the post-tax rate of return are calculated: NED-HCP, CPP-HCP, and CPP-NED (table 4). Looking at the differences between CPP and NED for the total company (see 4, 7, 10 and 13 in table 4) it can be seen that NED is a reasonable approximation of CPP for the EC pattern of inflation. This is true for all equity/total capital ratios in particular the higher values.

²²⁾ If starting from fixed total capital equity decreases and debt increases NED will give less deduction on HCP due to less equity. CPP gives a smaller deduction on HCP due to an increase in taxable inflationary gains. These two effects have the same sign and are of the same magnitude.

²³⁾ Compared with HCP this has as a cause that taxable capital gains according to CPP and NED are respectively lower and the same.

Table 4.

The differences in the post tax rate of return to equity (CPP value, percentage) between NED and HCP, CPP and HCP, CPP and NED for 4 equity/total capital ratios (20%, 40%, 60% and 80%) on the basis of the EC inflation and a tax rate of 35%.

	20%		40%		60%		80%					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	NED- HCP	CPP- HCP	CPP- NED	NED- HCP	CPP- HCP	CPP- NED	NED- HCP	CPP- HCP	CPP- NED	NED- HCP	CPP- HCP	CPP- NED
Equipment:												
81	-0.89	-1.39	-0.50	1.39	1.14	-0.25	2.15	1.98	-0.17	2.53	2.40	-0.13
82	-0.85	-0.02	0.83	1.22	1.64	0.41	1.92	2.19	0.28	2.26	2.47	0.21
83	-0.61	2.15	2.76	1.00	2.38	1.38	1.54	2.46	0.92	1.81	2.50	0.69
84	-0.35	3.00	3.34	0.94	2.61	1.67	1.37	2.49	1.11	1.59	2.42	0.83
85	-0.11	3.76	3.86	0.86	2.79	1.93	1.18	2.47	1.29	1.34	2.31	0.97
86	0.06	5.50	5.45	0.57	3.29	2.72	0.74	2.56	1.82	0.83	2.19	1.36
87	0.22	4.43	4.20	0.65	2.76	2.10	0.80	2.20	1.40	0.87	1.92	1.05
88	0.38	3.27	2.89	0.76	2.21	1.45	0.89	1.86	0.96	0.96	1.68	0.72
89	0.63	1.20	0.57	1.08	1.37	0.29	1.24	1.43	0.19	1.31	1.46	0.14
90	0.60	1.21	0.61	1.01	1.31	0.31	1.14	1.35	0.20	1.21	1.36	0.15
Buildings:												
81	-2.73	-11.33	-8.61	0.47	-3.83	-4.30	1.54	-1.33	-2.87	2.07	-0.08	-2.15
82	-2.39	-9.71	-7.33	0.45	-3.21	-3.66	1.40	-1.04	-2.44	1.88	0.04	-1.83
83	-1.79	-7.03	-5.24	0.41	-2.20	-2.62	1.15	-0.59	-1.75	1.52	0.21	-1.31
84	-1.39	-5.38	-3.99	0.42	-1.57	-1.99	1.02	-0.31	-1.33	1.32	0.33	-1.00
85	-1.00	-3.07	-2.69	0.41	-0.94	-1.35	0.88	-0.02	-0.90	1.12	0.44	-0.67
86	-0.51	-0.67	-0.17	0.29	0.21	-0.08	0.55	0.50	-0.06	0.69	0.65	-0.04
87	-0.41	-0.65	-0.25	0.34	0.22	-0.12	0.59	0.51	-0.08	0.71	0.65	-0.06
88	-0.32	-0.90	-0.58	0.42	0.13	-0.29	0.66	0.47	-0.19	0.78	0.64	-0.14
89	-0.28	-2.45	-2.17	0.63	-0.46	-1.08	0.93	0.21	-0.72	1.08	0.54	-0.54
90	-0.12	-1.91	-1.78	0.64	-0.25	-0.89	0.90	0.31	-0.59	1.03	0.58	-0.45
Land:												
81	-7.78	-14.66	-6.88	-2.06	-5.50	-3.44	-0.15	-2.44	-2.29	0.80	-0.92	-1.72
82	-7.65	-13.19	-5.54	-2.17	4.95	-2.77	-0.35	-2.20	-1.85	0.56	-0.82	-1.38
83	-6.50	-10.49	-3.99	-1.94	-3.93	-2.00	-0.42	-1.75	-1.33	0.34	-0.66	-1.00
84	-5.77	-8.91	-3.14	-1.77	-3.34	-1.57	-0.44	-1.49	-1.05	0.23	-0.56	-0.78
85	-4.89	-7.30	-2.41	-1.53	-2.74	-1.20	0.41	-1.22	-0.80	0.15	-0.46	-0.60
86	-2.98	-4.34	-1.36	-0.95	-1.63	-0.68	-0.27	-0.72	-0.45	0.07	-0.27	-0.34
87	-3.03	-4.34	-1.31	-0.97	-1.63	-0.66	-0.29	-0.72	-0.44	0.06	-0.27	-0.33
88	-3.25	-4.60	-1.35	-1.05	-1.73	-0.68	-0.32	-0.77	-0.45	0.05	-0.29	-0.34
89	-4.41	-6.16	-1.75	-1.44	-2.31	-0.87	-0.44	-1.03	-0.58	0.05	-0.38	-0.43
90	-4.11	-5.64	-1.53	-1.35	-2.12	-0.77	-0.43	-0.94	-0.51	0.03	-0.35	-0.38
Total ²⁴⁾ :												
81	-2.28	-5.48	-3.20	-0.04	-1.64	-1.60	0.71	-0.36	-1.07	2.55	1.75	-0.80
82	-2.18	-4.58	-2.14	-0.10	-1.30	-1.20	0.59	-0.21	-0.80	2.26	1.66	-0.60
83	-1.78	-3.07	-1.29	-0.10	-0.75	-0.65	0.46	0.02	-0.43	1.78	1.46	-0.32
84	-1.50	-2.26	-0.76	-0.08	-0.46	-0.38	0.39	0.14	-0.25	1.52	1.33	-0.19
85	-1.20	-1.34	-0.25	-0.05	-0.18	-0.12	0.33	0.25	-0.08	1.25	1.19	-0.06
86	-0.69	0.10	0.79	-0.02	0.37	0.39	0.20	0.47	0.26	0.75	0.95	0.20
87	-0.64	-0.11	0.53	0.00	0.27	0.26	0.22	0.40	0.18	0.76	0.89	0.13
88	-0.64	-0.45	0.19	0.03	0.12	0.10	0.25	0.31	0.06	0.82	0.87	0.05
89	-0.81	-1.48	-0.67	0.06	-0.28	-0.33	0.35	0.12	-0.22	1.11	0.94	-0.17
90	-0.73	-1.27	-0.54	0.06	-0.21	-0.27	0.32	0.14	-0.18	1.02	0.88	-0.14

24) The differences for equipment, buildings and land are multiplied by 0.2 (their share in total assets) and added together. The differences for inventories and monetary assets do not contribute to the total difference as they are zero.

However, NED approximates CPP only to a limited extent for an increasing and a constant rate of inflation.²⁵⁾ This can be concluded from the differences in the post-tax of return to equity for the total company. This is particular true when equity has a low share in total capital (see table 5). It is, however, important to emphasize that in these cases NED shows a higher post-tax rate of return than CPP.

From a policy point of view it is not just the difference between CPP and NED which is important. Equally important is what happens when a HCP system is replaced by NED or CPP. Except for the 20 and 40 % equity ratios a higher post-tax rate of return on equity of the total company would have resulted for the EC-pattern of inflation (see table 4). The same holds true for the two other inflation patterns.²⁶⁾ In addition CPP only taxes real capital gains while NED taxes capital gains in the same fashion as HCP.

Table 5.

The difference between the CPP and NED post tax-rate of return on equity (CPP value, percentage) for three types of inflation [decreasing (EC inflation), constant and increasing] and four financial structures (equity/total capital ratio 20, 40, 60, and 80 percent) and a tax rate of 35 %.

	20%			40%			60%			80%		
	Dec	Con	Inc	Dec	Con	Inc	Dec	Con	Inc	Dec	Con	Inc
1	-3.20	-2.37	-3.60	-1.60	-1.18	-1.80	-1.07	-0.79	-1.20	-0.80	-0.59	-0.90
2	-2.41	-1.91	-3.57	-1.20	-0.95	-1.79	-0.80	-0.64	-1.19	-0.60	-0.48	-0.89
3	-1.29	-1.87	-3.97	-0.65	-0.94	-1.99	-0.43	-0.62	-1.32	-0.32	-0.47	-0.99
4	-0.76	-1.80	-3.76	-0.38	-0.90	-1.88	-0.25	-0.60	-1.25	-0.19	-0.45	-0.94
5	-0.25	-1.77	-3.83	-0.12	-0.88	-1.92	-0.08	-0.59	-1.28	-0.06	-0.44	-0.96
6	0.79	-1.72	-3.60	0.39	-0.86	-1.80	0.26	-0.57	-1.20	0.20	-0.43	-0.90
7	0.53	-1.68	-3.62	0.26	-0.84	-1.81	0.18	-0.56	-1.21	0.13	-0.42	-0.91
8	0.19	-1.65	-3.99	0.10	-0.82	-2.00	0.06	-0.55	-1.33	0.05	-0.41	-1.00
9	-0.67	-1.61	-3.94	-0.33	-0.81	-1.97	-0.22	-0.54	-1.31	-0.17	-0.40	-0.98
10	-0.54	-1.59	-4.18	-0.27	-0.80	-2.09	-0.18	-0.53	-1.39	-0.14	-0.40	-1.05

²⁵⁾ In these cases, the differences between CPP and NED take the same sign for equipment, land and buildings. For the EC-pattern of inflation, the sign for equipment differs from those for the other two assets (see tables 3 and 4).

²⁶⁾ These results are not given in this paper but can be found in J.Ch.Caenen. Inflation and the fiscal concept of profit. (Inflatie en het fiscale winstbegrip), Dissertation, Tilburg, 1992.

5. Conclusions

As the post tax rate of return on equity is taken as the criterion it can be concluded that CPP is quite adequately approximated by NED when inflation decreases in time. The difference in the post rate of return can be positive as well as negative. The approximation is less adequate for a constant and an increasing rate of inflation. However, in these cases NED implies a higher rate of return. For all inflation patterns it holds that NED approximates CPP more closely the higher the equity/total capital ratio is.

Taxable capital gains on the sale of a company are considerably higher for NED in comparison with CPP. However, companies generally are compensated for this by lower annual taxable profits; an advantage that, in time, precludes the disadvantage concerning capital gains.

From a policy point of view, of course, the effects of replacing HCP by NED are relevant. Then, the conclusion is that NED can result in a higher but also in a lower post-tax rate of return. The lower rate is linked to low equity/total capital ratios. Taxable capital gains are not influenced by the introduction of NED in a HCP situation.

Appendix

In this appendix it will be demonstrated that $[(f \cdot Q_t^{qh} - (A_t^{qc} - A_t^{qh}))]$ equals zero when the rate of growth of investments in equipment at current prices (I_t^q) equals f and is constant in time. As was shown before ($g=f-\Pi$) and ($g=0; f=\Pi$) imply an annual increase at the rate f .

If depreciation is proportional at the rate d to the value of equipment and g and Π are constant in time, then the value of equipment at historic cost prices can be stated as:

$$Q_t^h = I_o^q(1+\pi)^t(1+g)^t + (1-d)I_o^q(1+\pi)^{t-1}(1+g)^{t-1} \dots + (1-d)^t I_o^q \quad (1)$$

If it is assumed that investments have an infinite lifetime it can be stated that for $t \rightarrow \infty$

$$\begin{aligned} Q_t^h &= I_o^q(1+\pi)^t(1+g)^t \int_0^{\infty} e^{t(-d-\pi-g)} dt \\ &= I_o^q(1+\pi)^t(1+g)^t \left[\frac{-1}{d+\pi+g} \cdot e^{t(-d-\pi-g)} \right]_0^{\infty} \\ &= I_o^q(1+\pi)^t(1+g)^t \left[\frac{1}{d+\pi+g} \right] \end{aligned} \quad (2)$$

On the basis of the supposed proportional rate of depreciation, $t \rightarrow \infty$ implies that each year the oldest vintage of equipment will be replaced by a new one so that a vintage model is actual.

For Q_t^c , the value of equipment at current consumption prices it can be stated that:

$$\begin{aligned} Q_t^c &= I_o^q(1+\pi)^t(1+g)^t + (1-d)I_o^q(1+\pi)^{t-1}(1+f)(1+g)^{t-1} \dots \\ &\quad + (1-d)^t I_o^q(1+f)^t \\ &= I_o^q(1+\pi)^t(1+g)^t \int_0^{\infty} e^{t(-d-\pi+f-g)} dt \\ &= I_o^q(1+\pi)^t(1+g)^t \left[\frac{-1}{d+\pi-f+g} \cdot e^{t(-d-\pi+f-g)} \right]_0^{\infty} \\ &= I_o^q(1+\pi)^t(1+g)^t \left[\frac{1}{d+\pi-f+g} \right] \end{aligned} \quad (3)$$

Because:

$$A^{qh}_t = d \cdot Q^h_t \quad (4)$$

and

$$A^{qc}_t = d \cdot Q^c_t \quad (5)$$

from (2) and (3) follows that

$$\begin{aligned} & [f \cdot Q^h_t - (A^{qc}_t - A^{qh}_t)] \\ &= I^q_o (1+\pi)^t (1+g)^t \left[\frac{d+f}{d+\pi+g} - \frac{d}{d+\pi+g-f} \right] \end{aligned} \quad (6)$$

This difference is equal to zero when investments in equipment grow yearly at the rate f . Above, it was shown that this is actual when $g=0$ and $\pi=f$ or when $g=f-\pi$. From (6) it results that in both cases the zero outcome is actual.

In reality g will be positive; as a rule the increase of consumption price will be higher than the increase of equipment prices.²⁷⁾ However $g = f - \pi$ does not have to hold. Therefore, in table 6 the results for (6) for some cases in which $g = f - \pi$ does not apply are given. In this table, the difference $[(f \cdot Q^h_t - (A^{qc}_t - A^{qh}_t))]$ is expressed as a percentage of Q^c_t .

Table 6.

$[(f \cdot Q^h_t - (A^{qc}_t - A^{qh}_t))]$ as a percentage of Q^c_t for $d = 0,1$.

	$f=0,05 \quad \pi=0,02$	$f=0,03 \quad \pi=0,02$	$f=0,03 \quad \pi=0,02$
$g = 0,01$	-0,76%	-0,25	0
$g = 0,02$	-0,35	0	0,21
$g = 0,03$	0	0,21	0,4
$g = 0,04$	0,31	0,4	0,56

From table 6, it can be concluded that the supposition $g = f - \pi$ will hardly result in other figures for the difference CPP - NED than can be calculated on more realistic suppositions.

²⁷⁾ See note 16.

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